FINAL-ET 39 - Electrician Theory Examination Marking Schedule

Notes: 1. (1 mark) means that the preceding statement/answer earns 1 mark.

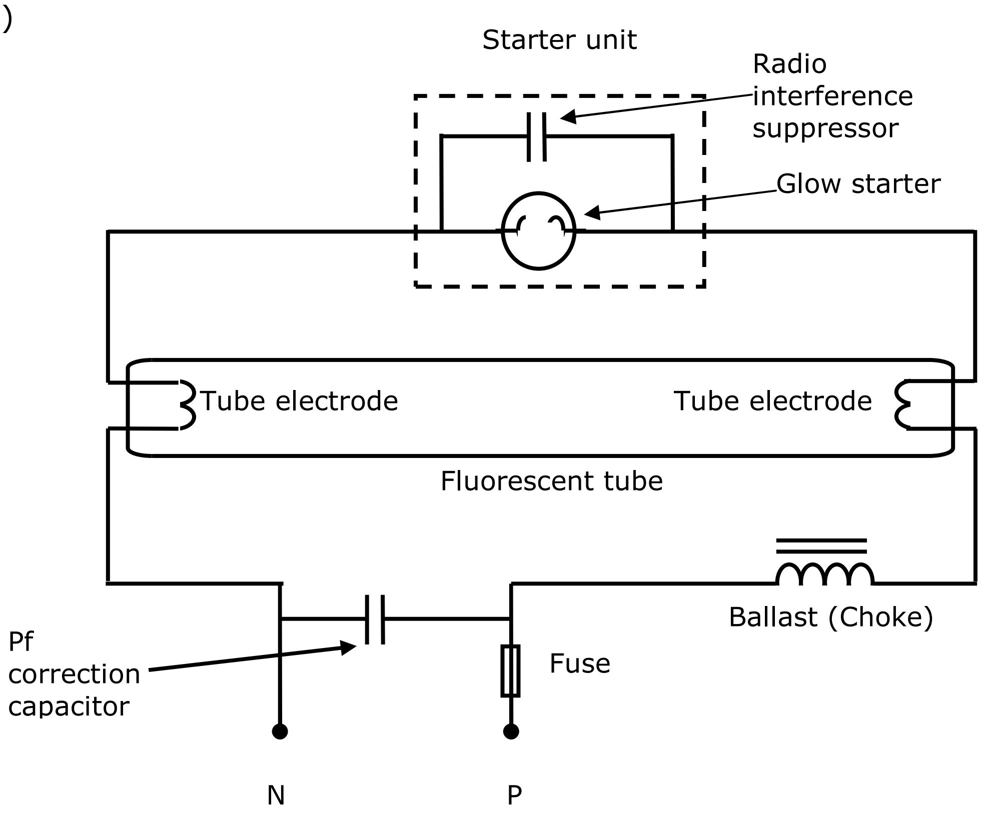
2. This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.

3. Symbols and terms - alternatives

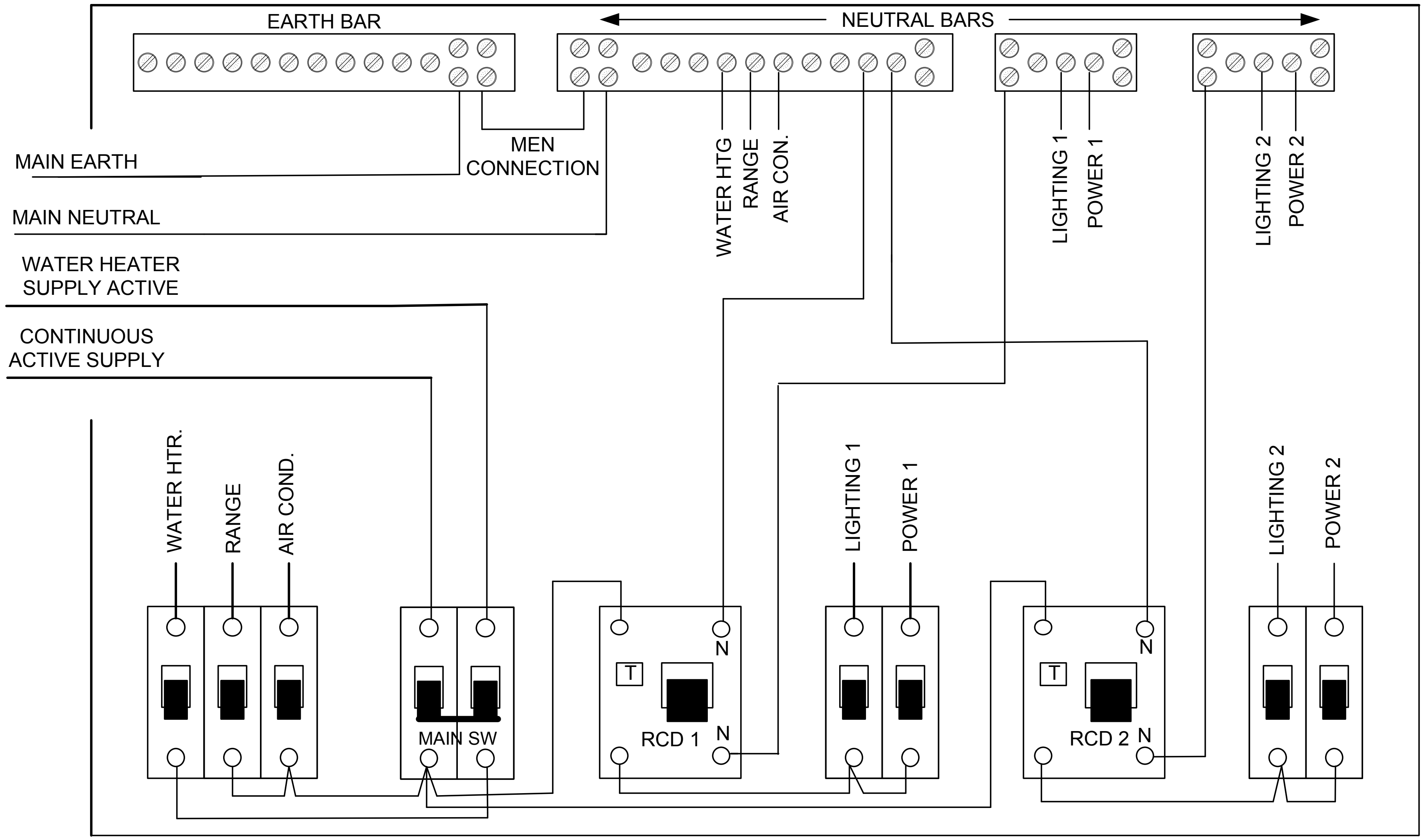
Power	W or P
Voltage	V or E or U
Phase	Active

Question 1	*Reference Marks*	*Marking notes*
(a) • If the circuit controlled by the switch was not continuous the meter would show a 0V reading. • Even though the oven may still be live	(1 mark) (1 mark)	
(b) • If a fuse opens (blows) or the fuse carrier removed high voltages could develop. • Which could damage the CT windings.	(1 mark) (1 mark)	
(c) Any TWO of: • In double-tube fittings, a capacitor connected in series with one ballast. or Install lead/lag fittings • Fittings are connected on different phases. • Incandescent lighting is interspersed with the fluorescent lighting.	(2 marks)	
(d) (i) The current imbalance (earth leakage) required to trip the RCD. (ii) 10 mA	(1 mark) (1 mark)	
(e) It was ineffective because no test was carried out between phase and earth or between phase and neutral.	(2 marks)	
(f) (i) In Star (ii) They have a constant rotating magnetic	(1 mark) (1 mark)	

Question 1	*Reference Marks*	*Marking notes*
field		
(g) Any TWO of: • Quieter running • Better running torque • Less current drawn • Increased efficiency	(2 marks)	
(h) Any TWO of: • Capacitors • Inductors • Resistors • Transistor • Zenor Diode • Voltage regulator	(2 marks)	
(i) • As the current through the protective device increases. • The time taken to operate decreases.	(1 mark) (1 mark)	
(j) Any TWO of: • Avoid damage to metal sheath • Maintain loop or "S" bend in cable. • Do not disturb pot seal • Do not over-flex the solid conductors • Ensure gland is clean and tight • Connections must be tight	(2 marks)	

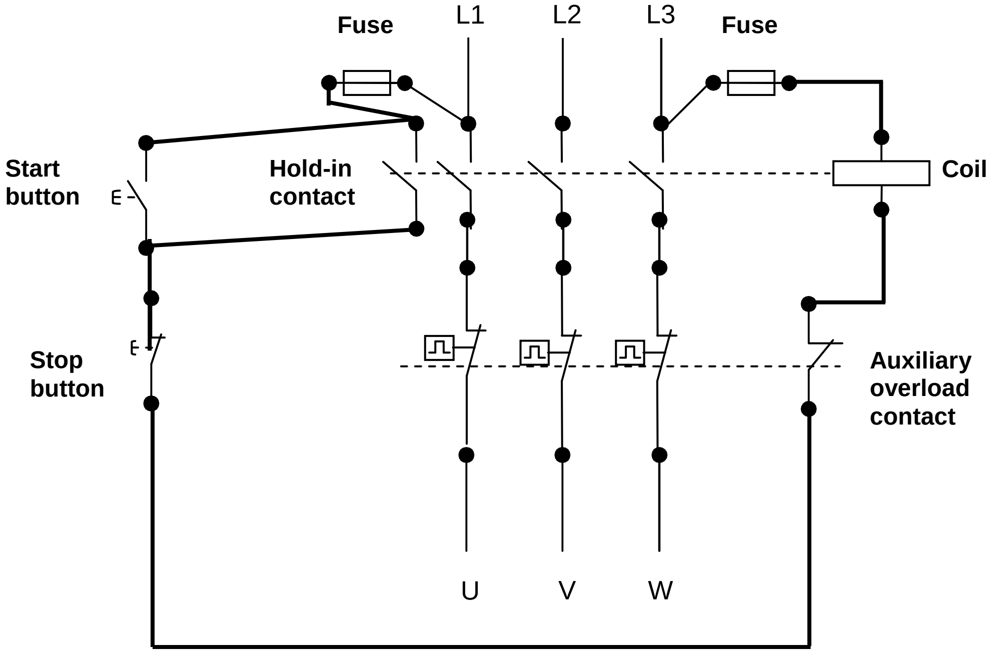
Question 2	*Reference Marks*	*Marking notes*
(a) (i)  Starter unit Radio interference suppressor Glow starter Tube electrode Tube electrode Fluorescent tube Ballast (Choke) Pf correction capacitor Fuse N P		
- Correctly connected starter unit	(1 mark)	
- Correctly connected tube electrodes	(½ mark)	
- Correctly connected ballast	(½ mark)	
- Correctly connected pf correction capacitor	(½ mark)	
- Correctly connected supply	(½ mark)	
- Correctly connected fuse	(½ mark)	
- Working circuit	(½ mark)	
(b) - The glow starter bimetal strip bends and closes the glow switch contacts.	(½ mark)	
- Current then flows through the ballast and tube electrodes	(1 mark)	
- Which heat up and cause ionisation of the gas in the tube at each end.	(1 mark)	
- The glow switch contacts open	(½ mark)	
- And a high-voltage surge from collapsing magnetic field in ballast, appears across tube and causes it to strike.	(1 mark)	
(c) Any TWO of: - To protect the eyes against the harmful effects of UV rays. - Creates the light colour - Converts UV light into visible light	(2 marks)	

Question 3


EARTH BAR
NEUTRAL BARS
MAIN EARTH
MEN CONNECTION
MAIN NEUTRAL
WATER HEATER SUPPLY ACTIVE
CONTINUOUS ACTIVE SUPPLY
WATER HTG
RANGE
AIR CON.
LIGHTING 1
POWER 1
LIGHTING 2
POWER 2
WATER HTR.
RANGE
AIR COND.
MAIN SW
T
N
N
RCD 1
LIGHTING 1
POWER 1
T
N
N
RCD 2
LIGHTING 2
POWER 2

Question 3	*Reference Marks*	*Marking notes*
• Correctly connected main earth conductor.	(½ mark)	The following situations are dangerous: 1. Failure to include the MEN link 2. Switching the neutral via the main switch or an MCB 3. A short circuit anywhere in the switchboard. No marks are awarded for the entire question if any of these situations are presented
• Correctly connected main neutral conductor.	(½ mark)	
• Correctly connected MEN link.	(½ mark)	
• Correctly connected water heater supply active (pilot).	(½ mark)	
• Correctly connected continuous active supply (the phase).	(½ mark)	
• Correctly connected supplies to the water heater, range and air conditioning MCBs.	(1 mark)	
• Correctly connected actives and neutrals for the RCDs.	(2 marks)	
• Correctly connected supply to lighting 1 and power 1 MCBs.	(½ mark)	
• Correctly connected supply to lighting 2 and power 2 MCBs.	(½ mark)	
• Correctly connected neutrals for the lighting 1 and power 1 final subcircuits.	(1 mark)	
• Correctly connected neutrals for the lighting 2 and power 2 final subcircuits.	(1 mark)	
• Correctly connected neutrals for the water heater, range and air conditioning final subcircuits.	(1½ marks)	

Question 4	*Reference Marks*	*Marking notes*
(a) There is a high resistance joint in the main neutral conductor.	(1 mark)	
(b) Any TWO of: ● Capacity (kA) of the supply source ● The impedance of the earth fault loop. ● Supply voltage.	(2 marks)	
(c) ● The main earth bar	(½ mark)	
● The main earthing conductor.	(½ mark)	
● The earth electrode	(½ mark)	
● The MEN connection (link)	(½ mark)	
● The main neutral bar	(½ mark)	
● The main neutral conductor	(½ mark)	
● Protective earthing conductors	(½ mark)	
● Equipotential bonding conductors	(½ mark)	
(d) Any ONE of: ● To connect the parts of an installation required to be earthed to the mass of earth. ● To keep the neutral potential to 0V ● To keep the phase potential to 230V	(1 mark)	
(e) There is supplementary insulation between the basic insulation and any metal that could become live under fault conditions.	(2 marks)	

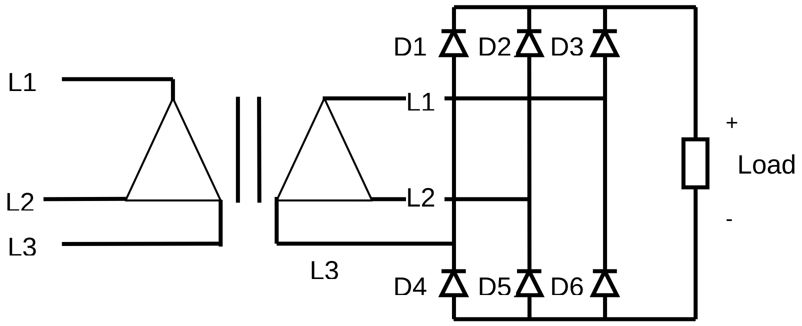
Question 5	*Reference Marks*	*Marking notes*
(a)  Fuse L1 L2 L3 Fuse Start button Hold-in contact Coil Stop button Auxiliary overload contact U V W		No marks for part (a) if: • Stop button does not open the circuit • Auxiliary overload contact does open the circuit • Circuit altered to operate at other than 400V
(i) Correctly connected control circuit.	(2 marks)	
(ii) To maintain the control circuit once the start button is released	(1 mark)	
(b) • The variable speed controller varies frequency and voltage to vary the speed.	(1 mark)	
• The electronic soft start varies voltage on starting to limit starting current.	(1 mark)	Reference to limiting the start current is required
(c) The adjustment that controls the length of time taken for a change in speed to take place.	(1 mark)	
(d) I in star = I DOL x 0.33	(½ mark)	
= 90 x 0.33	(½ mark)	
= 30A	(1 mark)	
(e) FLT DOL x 0.8^2	(½ mark)	
= 200 v 0.64	(½ mark)	
= 128%	(1 mark)	

Question 6	*Reference Marks*	*Marking notes*
(a) • Rewireable fuses have a variable utilisation category (fusing factor). • The utilisation category is usually about 2	(1 mark) (1 mark)	
(b) • Gg HRC fuses and MCBs have a specific utilisation category (fusing factor). • The utilisation category (fusing factor) is not more than 1.5	(1 mark) (1 mark)	
(c) The HRC only provide short-circuit protection for the circuit	(1 mark)	
(d) • Higher kA rating • Speed of operation	(½ mark) (½ mark)	
(e) • A protective device of adequate rupturing capacity is installed • In addition to a protective device of inadequate rupturing capacity	(1 mark) (1 mark)	
(f) • The protective device closest to the fault operates • Before any other protective device can operate	(1 mark) (1 mark)	

Question 7	*Reference Marks*	*Marking notes*
(a) (i) Primary I_L = Primary $I_{PH} \times \sqrt{3}$	(½ mark)	
= $15 \times \sqrt{3}$	(½ mark)	
= 25.98A	(1 mark)	
(ii) Se. V_{PH} = $\frac{\text{Sec } V_L}{\sqrt{3}}$	(½ mark)	
= $\frac{11000}{\sqrt{3}}$	(½ mark)	
= 6351 volts	(1 mark)	
Turns ratio = $\frac{33000}{6351}$	(½ mark)	
= 5.196 to 1	(1 mark)	
Sec I_L = 15×5.196	(½ mark)	
= 77.94 Amps	(1 mark)	
(iii) kVA = $\sqrt{3} \times PV_L \times PI_L$	(½ mark)	
= $\sqrt{3} \times 33000 \times 25.98$	(½ mark)	
= 1485 kVA	(1 mark)	
(b) Any TWO of: • Air cooled. • Oil cooled. • Pumped or natural convection. • Forced or natural ventilation.	(1 mark)	

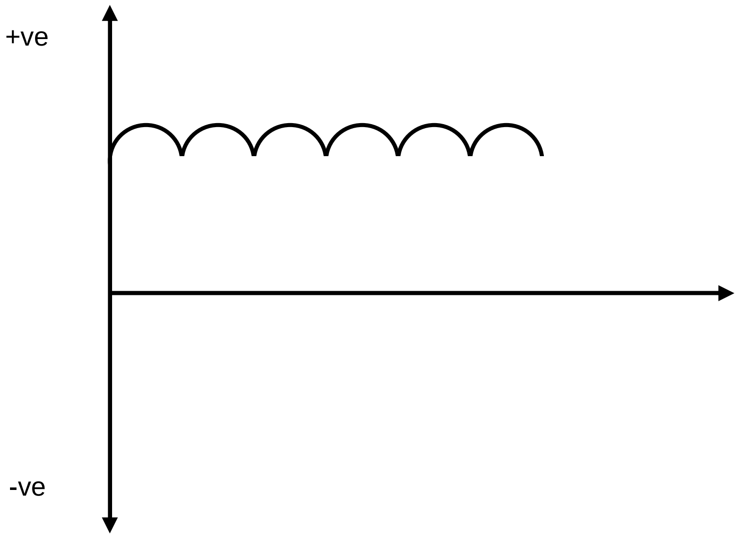
Question 8	*Reference Marks*	*Marking notes*

(a)



- Correct delta/delta transformer	(1 mark)	
- Secondary connected to correct points of bridge	(1 mark)	
- All diodes in correct configuration	(3 marks)	
- Load polarity correct.	(1 mark)	
(b) - Current flows from the most positive to the most negative line	(½ mark)	
- through one of the top diodes onto the positive rail	(½ mark)	
- through the load to the negative rail	(½ mark)	
- and back to the most negative line through the bottom diodes	(½ mark)	

(c) (i)



- Correct axis	(½ mark)	
- Correct polarity	(½ mark)	
- Correct waveform	(½ mark)	

Question 8	*Reference Marks*	*Marking notes*
(ii) Any ONE of: ● 300 Hz ● 6x the original frequency	(½ mark)	

Question 9	*Marks*	*Reference*	*Marking notes*
(a) Any TWO of: • The protective earthing conductor is open-circuited. • There is no earth to the socket • The Earth terminal is broken. • The MEN link is missing	(2 marks)		
(b) **Test 1**			The three tests can be shown in any order. For each test the function, range, method and result must relate to each other
• Insulation resistance test	(½ mark)		
• Insulation resistance function	(½ mark)		
• 500V d.c. range	(½ mark)		
• Test between phases	(½ mark)		
• Test between each phase and neutral and each phase and earth	(½ mark)		
• 1 MΩ or more	(½ mark)		
Test 2			
• Protective earthing conductor test	(½ mark)		
• Resistance function	(½ mark)		
• Lowest range or Auto-range	(½ mark)		
• Test between the end of the protective earthing conductor at the unconnected end of the cable and the earth pin on the socket outlet.	(½ mark)		
• Low enough for the protection to operate in the required time.	(½ mark)		
Test 3			
• Correct circuit connections test (or polarity)	(½ mark)		
• Resistance function	(½ mark)		
• Lowest range or Auto-range	(½ mark)		
• Test between each conductor and the unconnected end of the cable and corresponding pin on the socket outlet.	(½ mark)		

Question 9	*Marks*	*Reference*	*Marking notes*
● Each correct result would show low ohms	(½ mark)		